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A PROCEDURE FOR THE DETERMINATION OF THE TOTAL GAS CONTENT OF COAL

D.A. Young

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A PROCEDURE FOR THE DETERMINATION OF THE TOTAL GAS CONTENT OF COAL

by

D.A. Young*

ABSTRACT

This report describes the procedures used at the Cape Breton Coal Research Laboratory to determine the total gas content of coal. Furthermore, it presents the total gas content values of coal samples taken from various locations in the Cape Breton Development Corporation's Phalen, Lingan and Prince Mines. The samples were collected during the period 1985 to 1987.

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MÉTHODE DE DÉTERMINATION DE LA TENEUR EN GAZ TOTALE DU CHARBON

par

D.A. Young*

RÉSUMÉ

Dans le présent rapport, nous décrivons les méthodes employées au Laboratoire de recherche sur le charbon du Cap-Breton pour déterminer la teneur en gaz totale du charbon. Sont en outre indiquées les valeurs de la teneur en gaz totale d'échantillons de charbon recueillis à divers endroits dans les mines Phalen, Lingan et Prince de la Société de développement du Cap-Breton. Les échantillons ont été recueillis durant la période 1985-1987.

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INTRODUCTION

The Cape Breton Coal Research Laboratory (CBCRL) Environmental Group is carrying out a study and survey of coal gas emissions in the Cape Breton Development Corporation's (CBDC) coal mines. This includes identifying sources of coal gas and estimating the amount of gas released to the mines' ventilation network. Coal gas consists of approximately 90-95% methane. Furthermore, methane in concentration ranges of 5-15% by volume in air with at least 12.1% oxygen, creates a potentially explosive atmosphere. Therefore, it is important that the mines' ventilation system dilute the methane at the source and carry away the gas in a safe and efficient manner. The release of methane gas is proportional to the total gas trapped inside the coal's cavities.

The following report presents the procedures used at CBCRL to determine the total gas content of coal. It utilizes a slightly modified direct method that employs the displacement of water in a graduated glass cylinder to measure the quantity of gas released from a coal sample enclosed in a sealed vessel (1).

GENERAL PREPARATION PROCEDURES

SAMPLE CANISTER

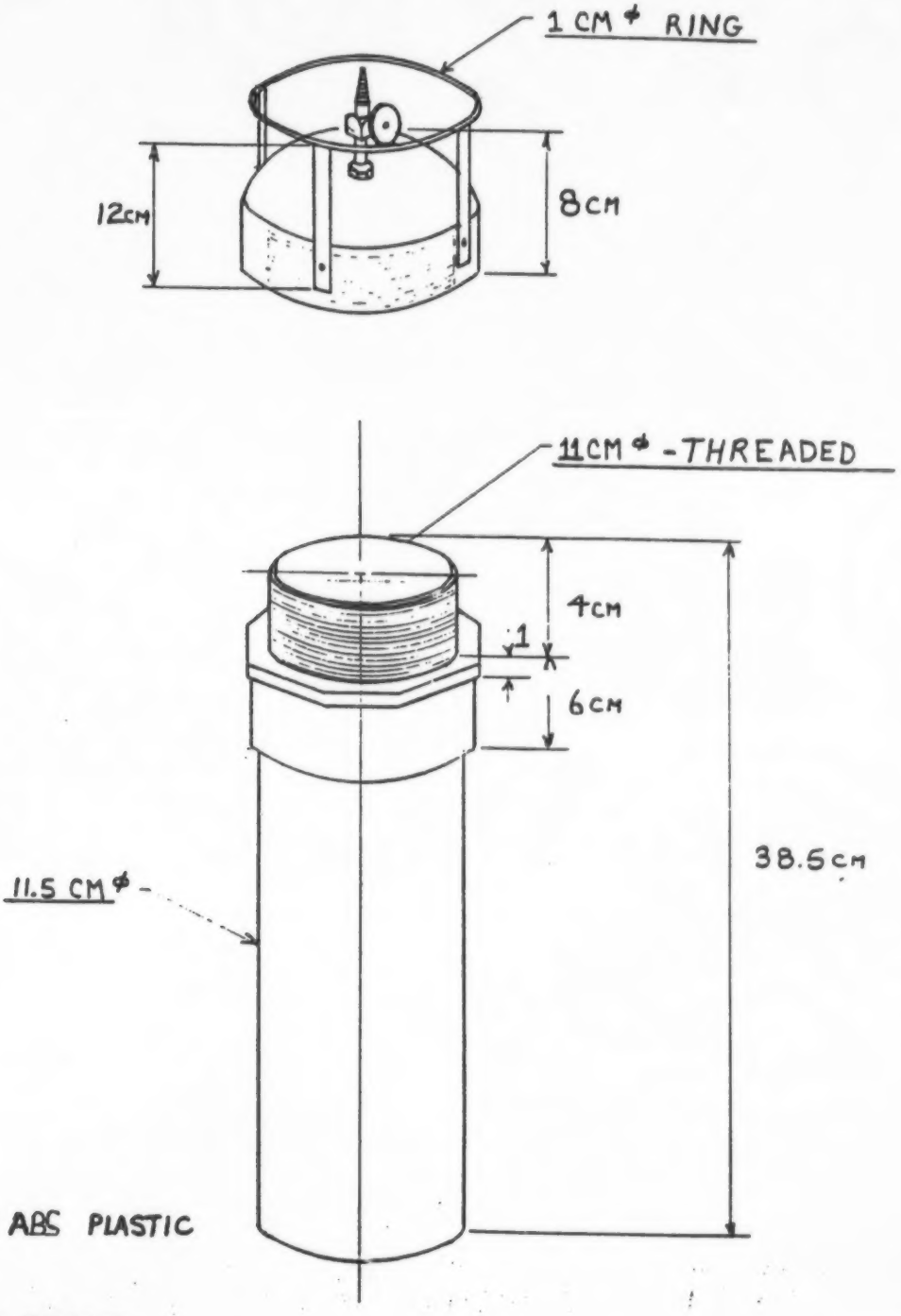
A sample canister is an airtight container used to enclose a sample of coal. It allows for the release of coal gas from the sample via an on/off valve. The canister used presently at CBCRL is constructed from ABS plastic components, Figure 1.

SAMPLE CANISTER PREPARATION

The sample canister preparation procedure consists of assembling and pressurizing the canister with air and checking for air leaks. The procedure is as follows:

1) Clean the inner and the outer surfaces of the canister with any suitable cleaning device, i.e. vacuum cleaner. Pay particular attention to the cleaning of the valve making sure it is unobstructed.

LEAKPROOF CANISTER



MATERIAL: ABS PLASTIC

NOT TO SCALE

Figure 1 - Leakproof canister

2) Put the canister together by threading the cover onto the cylindrical component. If necessary, apply extra torque to both components using a set of chain vice grips. This produces an airtight seal between the interface of the components and the O-ring seal.
3) Connect the canister to a source of air pressure using a piece of tubing.
4) Open the valve on the canister and pressurize with the air to 15 psi.
5) There are two methods in which the canister can be tested for air leakage, Figure 2.

   a) close the valve and disconnect the canister from the source of air. Submerge the canister into a trough of water and observe the surface of the water for escaping air bubbles.
   b) connect the canister inline with a sensitive differential pressure gauge (4.015×10^{-3} nt/m^2 = 1 in H_2O) and open the valve on the canister and let the pressure stabilize. Observe for a decline in the scale reading. If the cylinder is leaking, the pressure reading will decline.

   NOTE: This leak test is not very sensitive to minor leaks over a short period of time. It is recommended that this test be used only for quick checks of relative rapid air pressure loss.

6) Open the valve on the canister and release the compressed air. Unlock the two components of the canister with the chain vice grips.

If in either of the two cases a leak is suspected, the canister should be repaired in the defective area and Steps 1 to 6 be followed; if not, the canister is ready to be used to collect a sample of coal.

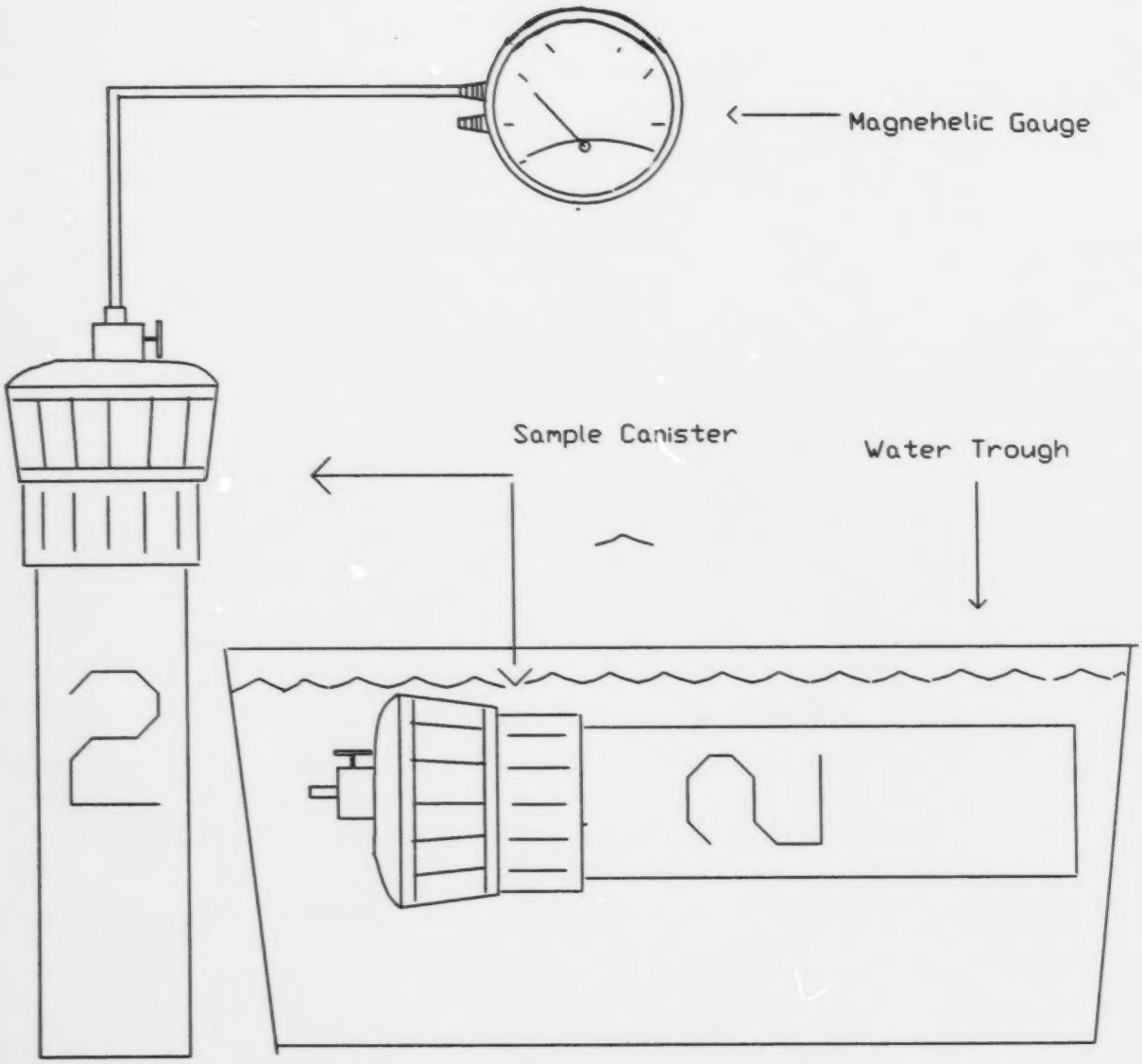


Figure 2 - Canister leak test apparatus

ROD MILL

DESCRIPTION

A rod mill is a device capable of pulverising a sample of coal to -200 mesh and maintains a gastight seal in the vessel during the crushing process.

The rod mill used at CBCRL consists of four basic components, Figure 3:

1) A hollow cylinder closed at one end and open at the other with a seal at the open end by means of a cover plate. The opposite end of the cylinder consists of a grooved out surface. This was designed to hold a 4 mm O-ring gasket to a depth of 2 mm. The outer ridge provides a small casing that supports the cover of the mill. Finally, there are two metal brackets located on this end that are used to secure a metal turn key and cover plate to the mill.
2) An iron cover plate that sits upon the O-ring gasket. The plate has two 12 mm threaded bored ports that are fitted with a valve and threaded iron plug.
3) An iron "T" screw threaded into the centre of a rectangular iron bar.
4) Twelve iron rods of equal length but different diameters for crushing the sample.

PREPARATION PROCEDURE

The rod mill preparation procedure consists of assembling and pressurizing the mill with air and checking for leaks. The procedure is as follows:

1) Clean the inner and outer surfaces of the cylinder, cover (including ports) and iron rods with a suitable device, i.e. vacuum cleaner. It is especially important that the surfaces in contact with the O-ring gasket and the valve assembly are cleaned thoroughly since these are the most probable areas in which leaks may occur.
2) Clean the O-ring gasket and apply a thin layer of silicone vacuum grease. Place the ring in the grooved end of the cylinder.

ROD MILL CRUSHER

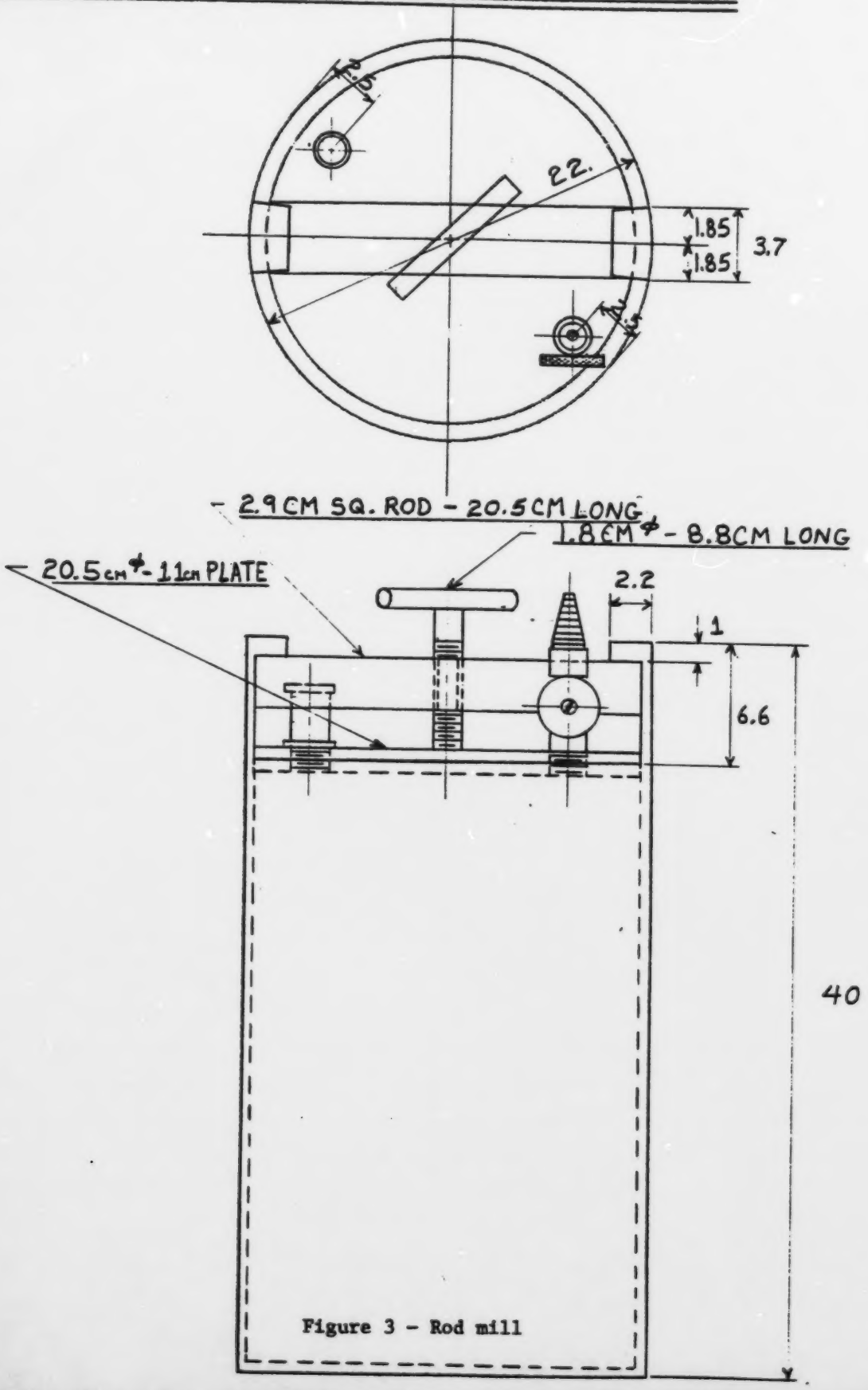


Figure 3 - Rod mill

3) Place the cover upon the mill and secure by fixing the turn key at the centre of the plate with the ends of the bar under the two brackets. Turn the key and secure the plate firmly down upon the O-ring gasket.
4) Apply a layer of teflon tape to the threads of the iron plug and screw into surface of cover plate. Open the valve and connect inline with a piece of tubing to a source of compressed air and pressurize the canister to 20 psi. Close the valve and shut the source of compressed air off.
5) Check for leaks by applying a soap solution to the surface of the mill and observe carefully for soap bubble formation.
6) Remove the pressure from the mill by opening the valve. If any leaks have been found, then correct the defected area and rerun Steps 1 to 5. If no leaks have occurred, then the mill is ready to operate as a coal crushing device.

GAS MEASURING APPARATUS

DESCRIPTION

The gas measuring apparatus determines the volume of a gas by the amount of water it displaces in a graduated column. The type used in the following procedures consists of three basic components:

1) 1 litre graduated column.
2) .5 litre glass levelling bulb.
3) Solid rubber stopper fitted with a single piece of stainless steel tubing 9 mm OD that is bent at a right angle. It also contains a thermometer. Both the tube and the thermometer pass through the stopper maintaining an airtight seal. The three components are assembled as shown in Figure 4.

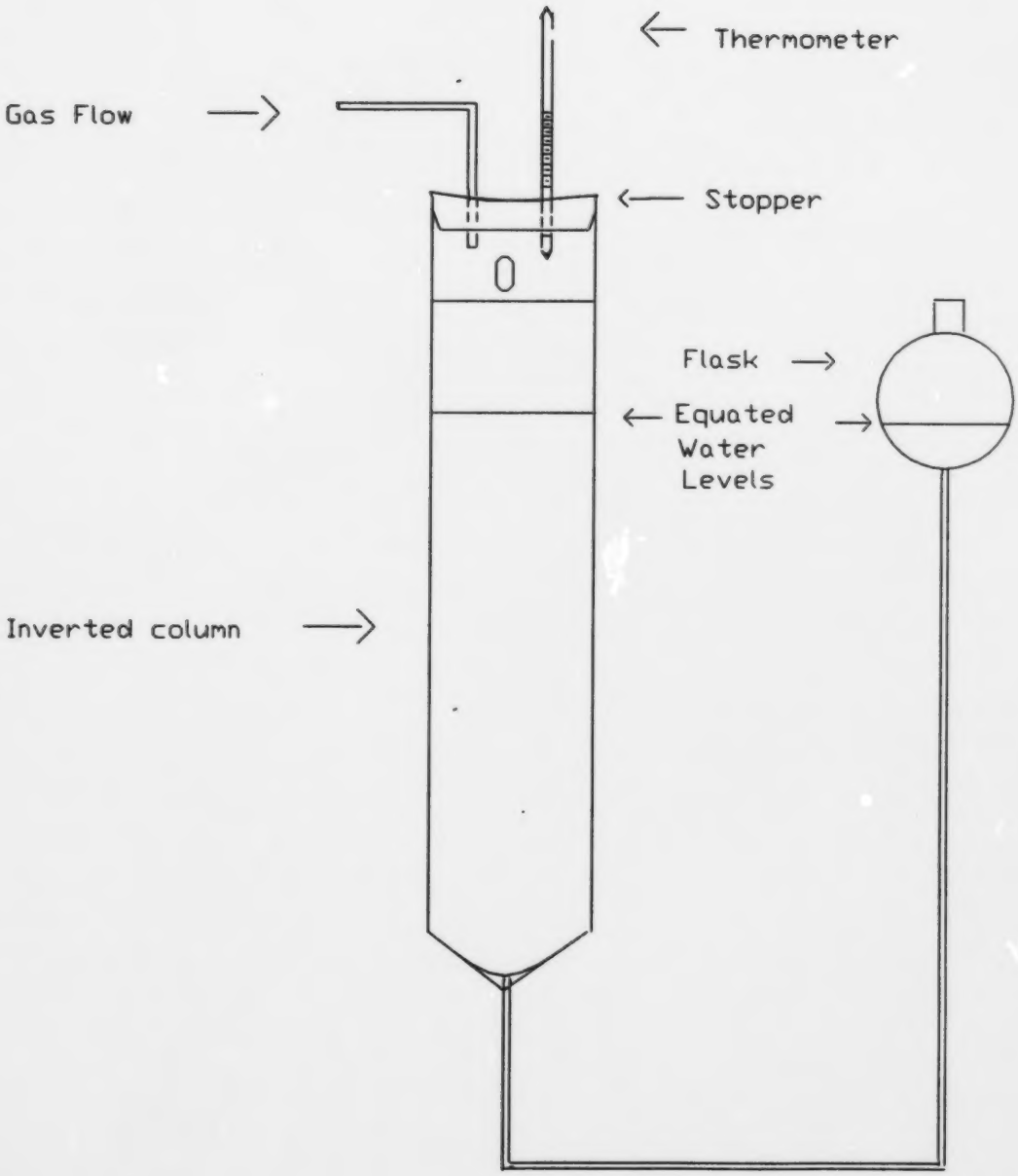


Figure 4 - Gas Measuring Apparatus

The following is a preliminary procedure for leak testing and carrying out measurements of gas using the water displacement apparatus:

1) Prior to assembly, the glassware is cleaned removing any contaminates that may cause water to adhere to the inner surfaces.
2) Assemble the three components as in Figure 4. Pay particular attention to the rubber stopper assembly keeping in mind that the steel tube and thermometer must form airtight seals.
3) First, raise the flask to a point near the initial measuring mark on the measuring column. Secondly, add distilled water to the levelling flask through the top end. This results in water passing down and out the base of the flask and into the column. Continue this to the point where the level of the water in the column is the same as in the flask. The flask should contain approximately 100 cc's of water for this allows room for the displaced water from the column during the measuring steps. Finally, add a small amount of coloured dye to the water for meniscus definition.
4) Test the system for water and/or air leaks by bringing the flask to the half point on the column; wait and allow water levels to stabilize. Pinch closed the tubing leading to the gas inlet.
5) Raise the flask up to the original position and observe the level of water in the column. If the level of water stabilizes and no water leaks occur, then it has an airtight seal. If the level beings to rise in the column, then a leak is suspected and must be corrected.

OPERATING PROCEDURE

The following steps are used to measure a volume of gas produced from a sample of coal retained in an airtight canister:

1) Bring the level of water in the column up to the initial measuring mark zero by raising the flask equating the water level in the flask and with the water level in the column. Fix the flask in place with a ring clamp.
2) Connect the valve on the sample canister for the test to the gas inlet of the column via a length of tubing. The column is now under normal laboratory pressure.

3) Slowly open the valve on the canister; this results in a down displacement of water in the column. Take the flask out of the clamp and maintain its level of water with that in the column by moving the flask at the same rate of displacement.

NOTE: It is possible that the pressure of the gas in the sample container may not exceed the change in barometric pressure between the underground site and the laboratory [Pressure (site) < Pressure (lab)]. In this case, the displacement of water may occur in the opposite direction. This normally happens with coals that have a low gas content or those that have been exposed to air for a long period of time. If there is evidence that a given coal sample is one of these two types, then make the initial starting mark 100 cc on the column and measure the upward replacement of air. Corrections for differences in pressure between the site and laboratory will be discussed later.

4) If the amount of gas is greater than the capacity of the column, close the valve on the canister and allow the two levels to come to equilibrium for 1 minute. Record the temperature of the column, laboratory barometric pressure and volume of water displaced in cc's.
5) If the volume of gas is less then the capacity of the column, allow the process to continue to an approximate flow rate of 2 cc/min or until gas release ceases. Close the valve and wait 1 minute to establish equilibrium. Record the temperature of the column, laboratory barometric pressure and volume of gas displaced in cc's.
6) Remove the gas from the column by providing a path for the gas to escape the top of the column. Do this by disconnecting the tubing on the canister or by using an inline three-way valve. In any case, raise the flask to the original position and repeat Steps 1 to 6 if necessary.

DETERMINATION OF TOTAL GAS CONTENT

DESCRIPTION AND PROCEDURE

The following is the description and procedure used at CBCRL to determine the total gas content of coal using the equipment and operating procedure previously mentioned.

The determination of total gas content consists of three basic parts and are briefly described below:

1) A pre-crush measuring period that consists of taking incremental measurements of gas from a sample canister recording temperature, pressure and gas volumes. This step may be started at the mine site using a smaller water displacement apparatus and continued back in the laboratory.
2) A lost gas measuring period in which an estimated rate of release of gas is determined to estimate the amount of gas lost during the time the sample is exposed to air in preparation for Part 3. This step consists of simply and quickly measuring volumes of gas on a 1 minute basis and determining an approximate gas flow rate. The temperature, pressure and volumes are recorded for each 1 minute test.
3) A post-crush measuring period in which the remaining or residual gas in a portion of the sample is determined by crushing a sample of coal in a rod mill below a 200 mesh (Tyler) screen size. This part consists of opening the sample canister and transferring the sample to the rod mill. The mill is flushed with nitrogen to displace oxygen and to reduce possible reactions.

The internal temperature of the mill is measured and is normally below laboratory temperature after insertion. The mill is sealed and placed on a set of rollers and rotated on the coal crushing apparatus, Figure 5.

The rolling process causes a cascading effect among the iron rods that reduces the coal sample to a fine particle size. The remaining gas is released from the coal creating a gas pressure in the mill.

The remaining gas is determined. Finally, the internal temperature of the mill is measured and it is normally higher than the pre-crush

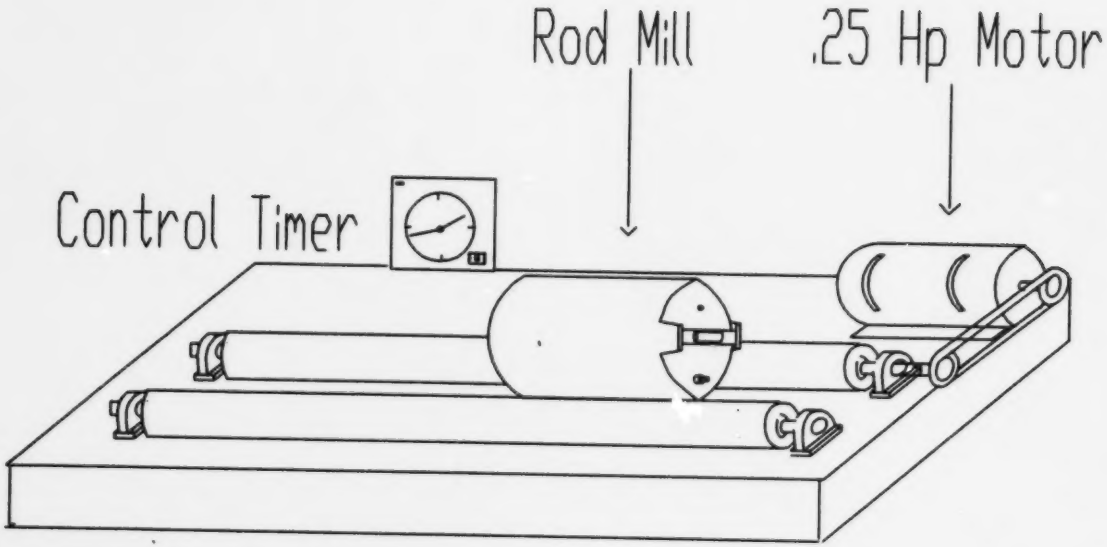


Figure 5 - Crushing apparatus

temperature because of the frictional heat created during crushing. The internal temperature measurement is used to apply a correction factor toward the final results.

It is not recommended that a pulverized coal sample be allowed to equilibrate for an extended period of time due the surface reactions and absorption of gas by the coal.

SAMPLE COLLECTION

Sample collection may vary depending on the site of interest; a retrieval plan should be followed.

The sample taken should not contain any visible impurities, i.e. bands of partings and/or pyrite. Relative environmental information such as temperature, barometric pressure, site condition and general operating activities are noted for further compilation.

When retrieved, the sample is put in the canister, being careful not to disturb or contaminate the O-ring. The cover is put into place as mentioned in the canister preparation procedure and the valved closed.

DETERMINATION OF THE TOTAL GAS CONTENT OF COAL

The following table lists the equipment and material needed for this procedure:

Table 1 - Equipment and laboratory material

Water Displacement Apparatus
Stopwatch
Barometer (Standard or Calibrated Aneroid)
Thermometer
Source of Nitrogen (Commercial Grade)
Rod Mill and Rolling Apparatus
Tubing and Connectors

PROCEDURE

The container with the sample are placed in the laboratory for at least two hours to allow for thermal equilibrium before starting this procedure.

Follow Steps 1 to 6 for operation of the gas measuring apparatus, then continue with the following:

7) Record the time. After 1 minute open the valve and allow gas to pass into the column for 60 seconds. Then close the valve and allow 1 minute for equilibrium. Record the temperature, pressure and volume of water displaced as in Step 4. Repeat this step for five 1-minute steps.
8) Weigh and record the mass of the canister plus the sample. Remove the sample canister cover and record the time. Carefully retrieve the sample setting aside a small portion for air dry moisture test and another portion for specific gravity test (SG). Place the remaining sample in a pan and determine the mass (M2).
9) Place the iron rods into the mill, allowing a space for the coal sample. Place sample (M2) into the mill.
10) Place the cover on the mill and secure into place as mentioned in the note on preparation of the mill for crushing. Open the valve and remove the iron plug. Insert a rigid piece of tubing into the cover down to the base of the mill. Connect a source of nitrogen to the tubing and flush out the canister for 1 minute at a pressure of approximately 2 psi.
11) Insert a thermometer into the plug hole and record the internal temperature. The temperature due to the insertion procedure is lower than that of the lab.
12) Remove the thermometer, close the valve and put the iron plug into place. Record the time.

NOTE: The carrying out of the last three steps usually takes 15-20 minutes.

13) Place the rod mill on the rolling device and crush the sample for 1 hour. Frequently monitor the rolling process and correct the position of the mill for travelling along the rollers.

14) Carry out Steps 1 to 5, and upon completion return to Step 15.
15) Open the valve on the mill and allow the gas to flow into the column until a steady state is attained. Wait 10 minutes and close the valve. This will be the last incremental measurement of gas. Record the final temperature, pressure and volume.
16) Remove the plug from the lid of the mill and insert a thermometer. Record the internal temperature of the mill and the barometric pressure.
17) Remove the lid and the iron rods from the mill. Retain 500 and 100 g splits of the sample for screen and proximate analysis.
18) Clean the mill thoroughly.

CALCULATIONS

There are four blocks of calculations utilizing the following formula:

$$TGC = [V(x) \times (STD\ T/T(x)] \times [p(x)/STD\ P)/m(x)] \qquad \text{Eq. 1}$$

where, TGC = Standardized volume of gas per gram of coal
V(x) = Measure increment of gas
STD T = Standard condition of temperature 273 K
STD P = Standard condition of pressure 760 mm Hg
T(x) = Measure temperature (K)
P(x) = Measure pressure (mm hg)
M(x) = Mass of the coal sample being tested (g)

The above formula can be used directly to calculate all individual gas volumes made with the gas measuring apparatus and to those corrections that apply to the sample canister, rod mill and lost gas test.

The first block of calculations using Equation 1 use gas volumes measurements made in Parts 1 and 3. The sum of these individual calculations represents the initial total gas content (TGC).

The following corrections are made to the TGC value and are stated in the following three blocks of calculations:

1) A change occurs in the sample canister pressure due to the difference in barometric pressure between the underground coal mine and the laboratory; this normally causes a net production of gas. For example, sealing a canister at 800 mm Hg and bringing it to a laboratory at a pressure of 760 mm Hg produces a net amount of air pressure and consequently a volume of excess air. This excess air must be subtracted from the initial result of TGC. This is done by determining the void volume (V1) of the sample canister by the following equation:

$$V1 = V - (M1/SG) \qquad \text{Eq. 2}$$

where, V = Internal volume of the sample canister
M1 = Mass of the collected coal sample
SG = Specific gravity of the coal sample

This value of V1 is used in Equation 1 to calculate the standardized volume of mine air (SV1) initially present in the sealed canister.

The value of V1 is used in Equation 1 to calculate the standardized volume of gas (SV2) present before the canister is opened in Part 2.

therefore, $$SV3 = SV1 - SV2 \qquad \text{Eq. 3}$$

SV3 is the first of three correction factors subtracted from TGC and represents the net production of gas between the mine and the laboratory.

2) The initial and final temperatures in the mill are significantly different before and after crushing because of the frictional heat. This produces a net gas pressure; consequently, the

production of excess gas must be subtracted from TGC. This is done by determining the void volume V2 of the rod mill by the following equation:

$$V2 = VM - (VR) - (M2/SG) \qquad \text{Eq. 4}$$

where, VM = Void volume of the mill
VR = Volume of the crushing rods
M2 = Mass of the coal sample
SG = Specific gravity of the coal sample

This value of V2 is used in Equation 1 to calculate the standardized volume of air (SR1) initially present in the sealed canister.

The value of V1 is used in Equation 1 to calculate the standardized volume of gas (SR2) present in the canister when all pre-crush gas has been measured.

therefore, $$SR3 = SR1 - SR2 \qquad \text{Eq. 5}$$

Where SR3 is the second of three correction factors subtracted from TGC and represents the production of gas due to the temperature increase in the mill during the crushing process.

3) The third and final correction applies to the determination of the gas lost during Part 2 in which the coal sample is exposed to air. In Part 2 a series of five 1-minute tests are carried out to determine an approximate desorption rate factor. This factor can be calculated by dividing the sum of the individual gas volumes VL, which are converted to STP by 5 minutes.

therefore, $$R = \text{Sum } VL/5 \qquad \text{Eq. 6}$$

where, R = Standardized lost gas rate (cc/min)
over the 5 minute measuring period

therefore, $$LG = (R \times TL)/M1 \qquad \text{Eq. 7}$$

where, LG = Total lost gas
TL = Lost gas period in minutes
M1 = Mass of crushed sample

LG is the final correction factor and is added to the TGC1. It represents the approximate gas lost from the coal sample while exposed to air.

The final total gas content equation for the calculations is summarized as follows:

$$TGC1 = TGC + LG - SV3 - SR3 \qquad \text{Eq. 8}$$

DISCUSSION

Table 2 contains total gas content results for thirty-eight samples of run of mine (ROM) coal collected from three CBDC coal mines. The results were obtained using the above procedures and pertain to the following discussion. However, a number of items should be discussed about the determination of total gas content procedures before elaborating on the results.

First, the section on the determination of lost gas is an estimation of the gas lost. The rate of gas loss could be affected by many factors, i.e. handling. To date, this correction is minimal and affects the final results, at most by 0.1 cc/g. The purpose of determining the lost gas is to check and to assure the technician that no appreciable amount of gas is lost during the transfer of the exposed coal sample.

Secondly, the determination of the SG of coal is carried out using a simple water displacement technique and this value is used to determine the volume of coal in the canister and the mill. It is assumed that the value SG is constant throughout the sample tests and that variations in this value will have a negligible effect on the canister and mill correction factors; hence, have negligible effect on the final TGC1 value.

Table 2 - Total gas content results (Lingan, Phalen and Prince)

Date	Mine	PE No. Ash Free m^3/Ton	Sample Location	Total Gas m^3/Ton	Total Gas Ash Free m^3/Ton	Moisture %	Ash %	Volatile %	F.C. %	Sulfur %	Btu's	True SG	As Received S.G	FSI
08-Oct-85	Lingan	239-85	6 West Jack 4	1.2	8.0	1.0	1.7	38.4	58.9	0.73	15075	1.260	1.2	8.0
08-Oct-85	Lingan	240-85	6 West Jack 4	8.2	8.5	1.0	1.6	37.3	60.1	0.46			1.2	8.0
15-Oct-85	Lingan	241-85	9 EB Belt	6.6	6.9	1.1	3.5	37.4	58.1	2.16			1.3	8.0
15-Oct-85	Lingan	242-85	9 EB Belt	6.8	7.2	1.0	4.8	37.4	56.8	3.42	14747	1.315	1.3	8.5
15-Oct-85	Lingan	243-85	9 EB Belt	7.2	7.5	0.9	3.8	37.8	57.5	2.27			1.3	7.5
15-Oct-85	Lingan	244-85	9 EB Belt	6.9	7.4	0.9	6.1	37.8	55.1	3.93			1.3	7.5
15-Oct-85	Lingan	245-85	9 EB Belt	5.5	5.9	0.9	6.6	37.7	54.8	4.76	14493	1.310	1.3	7.5
15-Oct-85	Lingan	246-85	9 EB Belt	7.3	7.7	1.3	4.4	34.9	59.4	1.02			1.3	8.0
21-Oct-85	Phalen	248-85	4 Deep Heading	6.5	7.0	2.4	4.4	33.2	59.9	0.85			1.3	7.0
21-Oct-85	Phalen	249-85	4 Deep Heading	5.9	6.2	3.1	1.8	35.7	59.4	0.54	14741	1.285	1.2	7.0
21-Oct-85	Phalen	265-85	4 Deep Heading	7.0	7.7	2.3	6.4	32.3	59.0	0.63			1.3	7.5
21-Oct-85	Phalen	266-85	4 Deep Heading	6.3	6.7	3.1	2.2	32.9	61.8	0.77			1.3	7.5
21-Oct-85	Phalen	267-85	4 Deep Heading	6.7	7.3	2.9	4.7	32.7	59.8	2.83			1.4	7.5
04-Dec-85	Lingan	270-85	9 east Jack 63	7.7	8.1	0.6	4.6	38.1	56.7	3.59			1.3	7.0
04-Dec-85	Lingan	271-85	9 east Jack 63	7.7	8.0	0.8	2.6	37.3	59.4	1.22	15012	1.120	1.2	7.5
04-Dec-85	Lingan	272-85	9 east Jack 63	8.3	8.6	0.7	2.6	37.0	59.7	1.5			1.3	7.5
04-Dec-85	Lingan	273-85	8 east Jack 83	7.0	7.2	0.7	2.7	38.3	58.3	0.42	14833	1.210	1.3	8.0
04-Dec-85	Lingan	274-85	8 east Jack 83	8.6	8.8	0.8	1.1	37.0	61.1	0.43			1.3	8.0
04-Dec-85	Lingan	1-86	6 west Jack 130	8.0	8.1	0.9	1.6	37.1	60.5	0.49			1.3	8.0
04-Dec-85	Lingan	3-86	6 west Jack 130	7.3	7.5	0.7	1.5	36.9	60.9	0.46			1.3	7.0
04-Dec-85	Lingan	4-86	6 west Jack 130	8.7	9.0	0.8	1.7	37.2	60.2	0.49	14992	1.280	1.3	7.0
04-Dec-85	Lingan	5-86	6 west Jack 130	8.2	8.4	0.8	2.0	36.4	60.9	0.46			1.3	8.0
16-Jan-86	Prince	6-86	4 west Jack 65	1.1	1.2	3.4	2.4	36.9	57.3	1.34	14044	1.32	1.3	6.0
16-Jan-86	Prince	7-86	4 west Jack 65	1.0	1.1	3.5	4.9	35.1	56.5	2.75			1.3	5.0
05-Feb-86	Phalen	10-86	4 Deep Heading	6.2	6.4	1.6	2.2	36.5	59.7	1.38			1.3	8.0
05-Feb-86	Phalen	11-86	4 Deep Heading	6.6	6.9	1.6	2.3	37.6	58.5	1.46			1.3	8.0
05-Feb-86	Phalen	12-86	4 Deep Heading	5.5	6.0	1.2	7.0	39.5	52.4	0.82			1.3	7.5
05-Feb-86	Phalen	13-86	4 Deep Heading	5.6	6.0	1.4	4.7	38.1	55.8	0.76	14344	1.3	1.3	8.0
06-May-86	Lingan	31-86	6 West Jack 119	9.2	9.4	1.2	1.7	39.3	57.9	0.75	14866	1.25	1.2	7.5
06-May-86	Lingan	32-86	6 West Jack 119	6.7	8.5	1.2	19.2	32.1	47.5	1.58	11786	1.43	1.2	4.5
06-May-86	Lingan	33-86	6 West Jack 119	7.7	8.0	1.2	3.0	39.0	56.8	1.58	14266	1.28	1.3	7.5
21-May-86	Lingan	35-86	6 West Jack 20	6.5	7.1	1.2	7.2	36.4	55.2	3.42	13466			7.0
06-May-86	Lingan	37-86	6 West Jack 20	6.3	6.6	1.2	4.0	37.8	57.1	2.60	14209			7.5
06-May-86	Lingan	38-86	6 West Jack 20	5.4	6.0	1.1	9.6	35.8	53.5	2.20	13142			6.5
06-May-86	Lingan	39-86	6 West Jack 20	5.4	6.1	1.1	11.0	35.2	52.7	2.29	13121			7.0
06-May-86	Lingan	40-86	6 West Jack 20	6.3	6.7	1.1	4.5	37.4	57.0	1.50	14077			7.5
06-Oct-86	Phalen	909-86	5 Deep Heading	4.7	5.1	2.5	6.4	31.4	59.7					
06-Oct-86	Phalen	910-86	5 Deep Heading	5.2	5.7	2.1	6.1	33.1	58.7					

The results of Table 1 present a range of information about the coal samples tested. The results of total gas content are in agreement with application of a similar method to samples from the same seam (2).

Figures 6 and 7 present plots of total gas content verses % ash of ROM samples collected from three CBDC mines.

Figure 6 is of particular interest because it shows a trend of increasing gas content as the % ash approaches zero. This seems reasonable since the formation of methane is a product of the carbonaceous component of the coal. The slope of this line seems uniform and there appears to be good correlation among this data. Of these, eleven samples were collected from the Lingan Mine's east side and fourteen from its west side districts - over a period of two years. The good correlation can be explained on the basis that the samples were taken from a general cross section of the Lingan coal seam. This suggests a relationship between the coal's gas and ash content. The total gas content of two Prince Mine samples were presented for comparison purposes only.

Figure 7 is a plot similar to Figure 6 and describes samples collected from the CBDC's Phalen Colliery. Unlike Figure 6, there is less correlation in this plot. At this time, sampling was carried out in the development headings of the main slopes. More samples, collected in a consistent manner, will be tested before further comment on the coal from Phalen Mine.

CONCLUSION

In order to determine the total gas content of coal, a procedure as presented in this report is needed. This procedure includes descriptions of overall methodology, individual steps, lists of equipment and figures. It also explains the calculation of the gas content results and the application of correction factors to the determination of final total gas content.

Next, the creation of a data base containing the total gas content results of many coal samples retrieved systematically from the various locations in a coal seam can assist in the projection of an in situ coal gas content value.

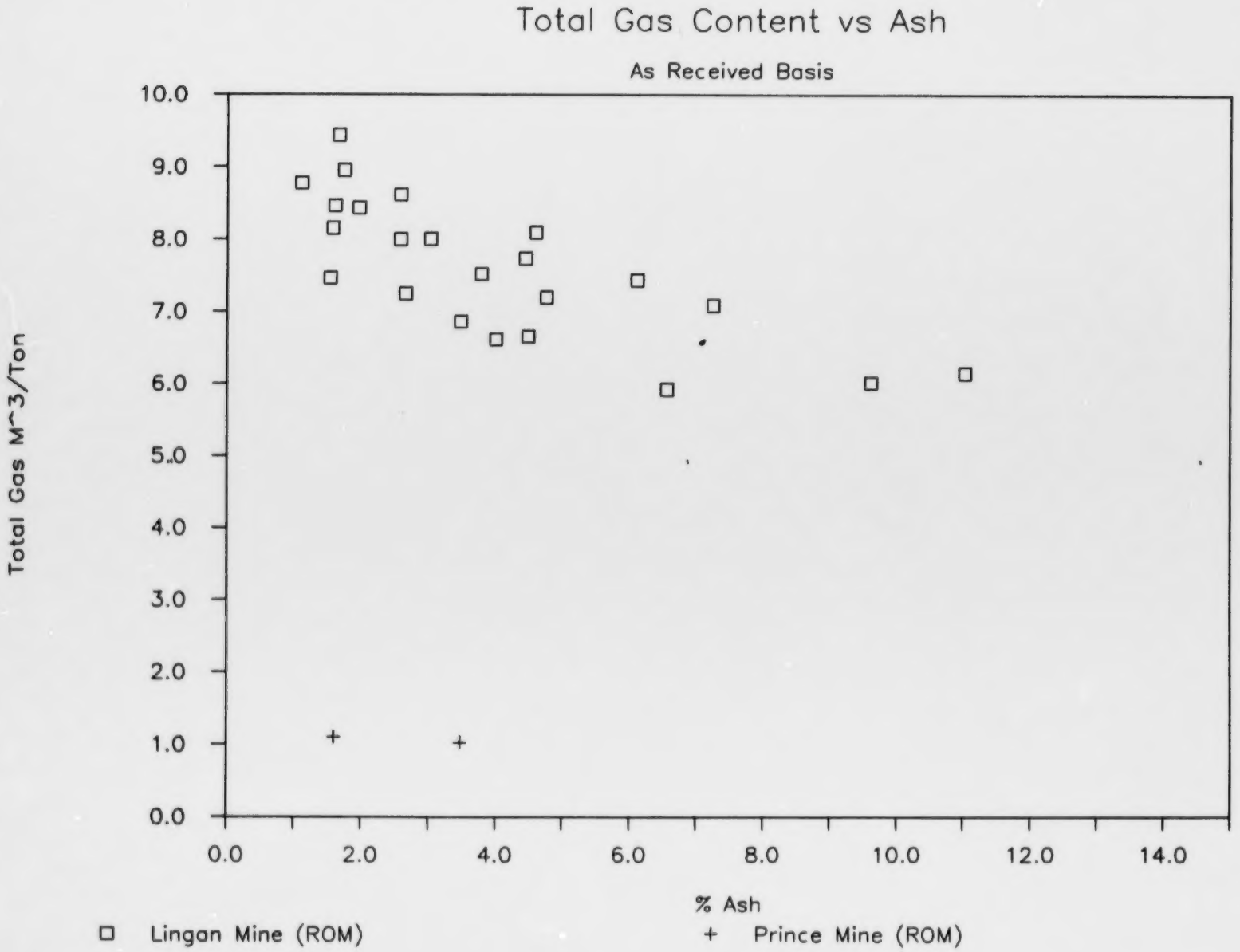


Figure 6 - Total gas content vs % ash (Lingan)

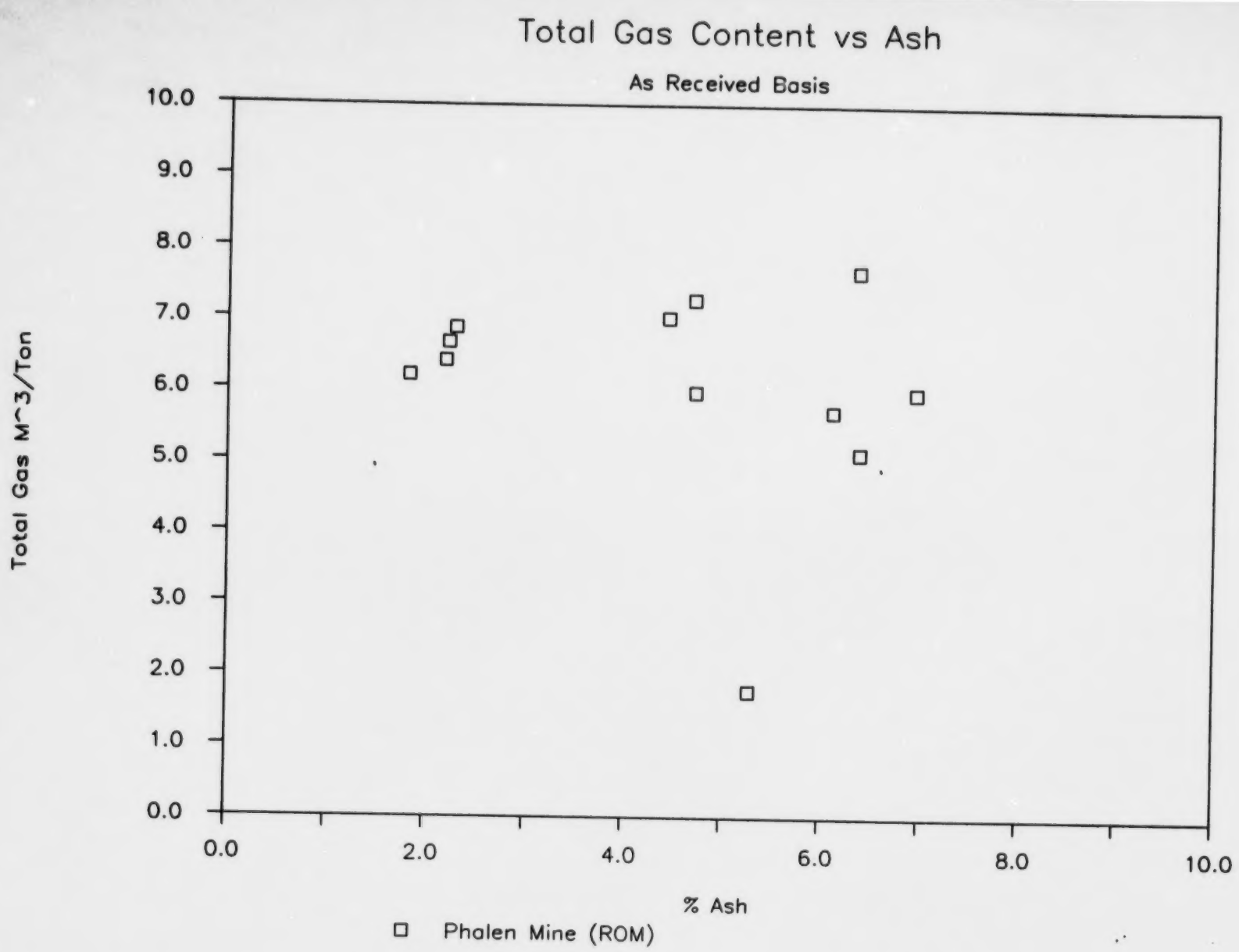


Figure 7 - Total gas content vs % ash (Phalen)

Finally, this report is a description of an approximate method of the determination of the total gas content of coal. The results obtained from this report, in conjunction with other studies of gas emissions by the Environmental Group at CBCRL, will lead to a better understanding of this phenomena as it relates to more indepthstudies by the group.

REFERENCES

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2. Feng, K.K., Cheng, K.C. Augsten, R. "A preliminary study on methane desorption of Sydney coal from Devco mines"; Energy, Mines and Resources, Mining Research Laboratories, Canadian Explosives Laboratory; 1983.